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APPRECIATION

Michael Mayeku Werikhe, 1956–1999

Michael Werikhe's life was short, but he lived it to the full. He was a herpetologist, a crusader for conservation, a fundraiser for wildlife, a global award winner, and a worker, husband and father. He had become a goodwill ambassador for Kenya and a role model for countless young environmentalists. "The rhino will live or die because of us," Werikhe used to say to audiences across the world. And today, in part because of his efforts, the black rhinoceros lives and is increasing in Kenya.

As a small boy in Mombasa, Michael developed his passion for nature, roaming the shores and mangrove forests, bringing wild pets home, teaching others not to fear them. Attending primary school in Nairobi, he spent his free time at the National Museum's Snake Park, soon becoming an accomplished herpetologist. His plans to make a career in wildlife management were shattered by his experiences: counting tusks and rhino horns from poached animals in the old Ivory Room, or catching snakes for a collector who had no regard for their conservation. Disheartened, he joined the Associated Vehicle Assemblers (AVA) factory, where his passion still burned, and he gave talks about snakes to fellow workers.

Hunting for sport and clearing land for agriculture and settlement had put pressure on the black rhinoceros in Kenya since the last turn of the century. In the 1980s the rhino was in steep decline, poached for its horn which was smuggled out to make dagger handles in Yemen or medicines in East Asia. Michael Werikhe wanted to do something to save the endangered rhino, and he thought of a way. He decided to spend his annual leave, over the 1982-83 holiday season, walking from Mombasa to Nairobi to raise awareness about the black rhino and funds for its conservation. The lonely figure, stooped under an umbrella propped up on his backpack, burned itself onto the records of conservation.

Werikhe believed deeply in his cause, and convinced others to believe in him. Crucial initial support came from Nehemiah Rotich of the East African Wild Life Society (now Director of

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Kenya Wildlife Service); Juanita Carberry of the World Society for the Protection of Animals; Nathaniel Chumo of the Wildlife Clubs of Kenya (now with the National Environment Secretariat); Kuki Gallmann of the Gallmann Memorial Foundation; and from Peter Hughes, Managing Director of AVA.

The walks grew in length and scope: Across East Africa, 2080 km from Kampala to Kenya and Tanzania, with a triumphal return to Mombasa on his 29th birthday, 25 May 1985. Across Europe in 1988, 2880 km from Assisi in Italy through Switzerland, Germany, the Netherlands and Britain, with the support of the World Wide Fund for Nature. Some 2400 km through 30 American cities in 1991, with the help of the American Association of Zoological Parks and Aquariums. And in Taiwan, where trade in endangered species flourished, in 1994.

Werikhe walked and talked. Unassuming and soft-spoken, he talked with quiet determination and conviction. He talked to millions of people about the plight of the rhino, and also about what African people and governments were doing to save it. He talked about how each person could help, by not buying wildlife products, by recycling, by taking part in environmental action. He gave a human, committed face to African conservation.

"The fact that you are from Africa, and as an African doing something for conservation, will not be lost on the American people," Richard Leakey, Director of the Kenya Wildlife Service, told Michael Werikhe as he launched the 1991 Rhino Walk in the United States and Canada. "Regardless of the financial outcome, the political, sociological and public respect outcome is already assured."

Werikhe did raise money, which went to rhino conservation projects in Kenya, Tanzania, Cameroon, Namibia and Zimbabwe. Black rhinos in Kenya were translocated to rhino sanctuaries such as Nairobi and Nakuru National Parks. Esmond Bradley Martin and Lucy Vigne found substitutes for carved dagger handles. The combined actions of many people, on many fronts, began to turn the tide. Today black rhino numbers in Kenya have risen from 350 to 480 – a healthy increase and hope for the future.

Michael Werikhe

After five walks on four continents, Werikhe turned his attention to projects closer to his Mombasa home. He was active in raising funds to support the re-introduction of rhinos into Tsavo East National Park, and to help local primary schools to benefit rather than suffer from their proximity to wildlife. His was hands-on support, with frequent visits and hard work.

The EANHS wishes to thank the following for their support in 1999:

Sponsors of the Society:

Arturo Foresti
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J.H.E. Leakey
Bas van Helvoort
Sulyn Talbot

Corporate member (overseas):

Wiliam Glover

Major Donors:

Royal Society for the Protection of Birds
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Meanwhile the AVA factory turned green as thousands of tree seedlings were planted in the grounds and surrounding neighbourhoods.

Michael Werikhe was recognised as a hero in his own lifetime. During and after his walks to save the rhino he was awarded a number of prestigious honours; he became one of UNEP's Global 500 in 1989, and a winner of the first Goldman Environmental Prize in 1990. Werikhe continued to travel and to talk, and walked each year with the San Diego Zoological Society in the United States. His wife Hellen and two small daughters often travelled with him.

Tragedy first struck in 1996, when Hellen died suddenly. Michael brought up his daughters Acacia and Kora with the help of his aunt Grace John Werikhe in Mombasa. Michael Werikhe and his children were named the "First Family" of Disney World's Animal Kingdom in Florida, USA, at its opening.

In August 1999 Michael Werikhe succumbed to illness bravely fought, compounded by a mugging on his way to work. His daughters have found a secure home with their cousins in Nairobi. The black rhinos have found a safe haven in Kenya's national parks and private sanctuaries.

Fleur Ng'weno
PO Box 42271, Nairobi

Michael on one of his walks accompanied by a young rhino.

Michael Werikhe Children Trust

In August 1999 our friend and trustee, Michael Mayeku Werikhe, died in Mombasa, as most of you know.

There was something unique about Michael, but more than anything, apart from his immense drive and dedication to the cause of rhino conservation, he was a modest and frugal person, and one who had put all his time and resources to make a difference, without seeking any personal benefit. He died still in the prime of life, and left nothing to his children, but his example and the memory of his love. A man who had raised in excess of two million dollars for conservation had never asked nor kept anything for himself.

His wife Hellen had died a few years ago. His daughter Acacia is eleven and Kora is nine. They are orphans and need money for their education and welfare. A cousin with children of her own has taken the responsibility to look after them, but funds are badly needed.

A close group of friends has started the Michael Werikhe Children Trust, to take care of his children. I am one of the trustees. The others are Fleur Ng'weno, the lawyer who drew up the deed and two members of his family, the cousin who looks after the children and his old aunt.

A bank account has been opened as follows:
Michael Werikhe Children Trust
account number 0102073555600
Standard Chartered Bank (Kenya) Ltd,
Harambee Avenue branch, Nairobi Kenya

I appeal to the generosity of whoever knew and respected Michael, to contribute towards this Fund either by wire transfer or personal cheque, that could be sent, if you prefer, c/o myself, Kuki Gallmann, at P.O. Box 45503, Nairobi, Kenya, by registered mail. Should you choose the transfer, please let me know so that we may acknowledge your donation and ensure it has safely reached the account. I assure you that the money will be spent for the purpose for which it is intended, and hopefully an endowment can be established in time.

On behalf of Michael's daughters and of Michael himself, I would like to thank you very much for anything you may be able to do. We cannot change the past, but can ensure that a brighter future and good education can be available to these lovely and innocent girls.

With thanks and blessings
Kuki Gallmann
From: Kuki Gallmann
<gmfkenya@africaonline.co.ke>

ARTICLES

ECOLOGICAL MONITORING: ITS IMPORTANCE FOR THE CONSERVATION OF BIOLOGICAL DIVERSITY IN THE EASTERN ARC FORESTS

The Eastern Arc forests of Tanzania have been classified as one of the 14 most threatened tropical forest hotspots worldwide because of their unusual concentrations of endemic species and the significant threats facing them (Myers 1990, 1991). The purpose of this paper is to briefly highlight the useful role that ecological monitoring can play as part of a broader program of activities to conserve biological diversity and to discuss current and planned ecological monitoring activities in the East Usambaras.

INTRODUCTION

The Eastern Arc Mountains (Figure 1) are, for their size, the richest site biologically in Tanzania. Although the closed forests of the Eastern Arc Mountains cover less than 2% (1,800 sq km) of the land surface of mainland Tanzania, these forests contain approximately 18% of all plants, 43% of all butterflies, 22% of all amphibians and reptiles, 26% of all birds, and 24% of all mammals found in mainland Tanzania (Newmark in prep.). Possibly even more importantly, these forests contain one of the highest proportions of endemic species of any region in Africa. Approximately 25% of plant species, 82% of linyphiid spider species, 39% of butterflies species, 66% of herpetofauna species, 28% of montane bird species, and 7% of mammals species are endemic to the Eastern Arc mountains (Newmark in prep.). Furthermore, the Eastern Arc forests contain the majority of the globally endangered, vulnerable, and rare mammal and bird species and subspecies found in mainland Tanzania (Newmark, in prep.).

As a result of their unusual diversity and endemism, there has been considerable interest both nationally and internationally in conserving the biological diversity of the Eastern Arc Mountains. A number of projects have been implemented (e.g., East Usambara Forest Catchment Project, East Usambara Agriculture and Conservation Projects, and proposed Ambangulu Conservation Project) and protected areas (e.g., Udzungwa National Park and proposed Amani Nature Reserve) established in the last 10 years to conserve biological diversity in the Eastern Arc forests. The long-term success of these projects and protected areas is dependent upon reducing human pressures upon the forests, increasing the effectiveness of forest management, and developing a more complete understanding of the ecological dynamics of these forests. Ecological monitoring is central to particularly these latter two requirements.

The Eastern Arc Mountains of Tanzania and Kenya. (Mt Kilimanjaro is not an eastern Arc Mountian) (from Cordeiro, in press).

BROAD-SCALE STRATEGIES FOR CONSERVING BIOLOGICAL DIVERSITY

Biological diversity is the natural variation in genes, populations, species, communities, eco-systems, and landscapes (Wilson 1988). This variation changes both through space and time. In addition, this variation is a result of the interaction of organisms with their environment of which such ecological and evolutionary processes as predation, competition, nutrient cycling, energy flows, succession, pollination, disturbance, dispersal, and movement are particularly important. Thus the conservation of biological diversity requires not only conserving the spatial and temporal dimensions of biological diversity but also maintaining the ecological and evolutionary processes upon which this natural variation is dependent.

In principle, information and activities required to conserve biological diversity does not differ from that required to conserve most other resources. That is one must know: (1) the location of the resource; (2) the abundance of the resource; (3) changes in the abundance of the resource over time; and (4) factors responsible for changes in abundance in the resource over time.

The process of documenting the location and relative abundance of biological diversity may be thought of as inventory, while that of identifying the temporal variation in biological diversity and factors responsible for this variation can be considered as ecological monitoring.

IMPORTANCE OF ECOLOGICAL MONITORING FOR FOREST MANAGEMENT

Ecological monitoring is important for forest management for a variety of reasons. First, ecological monitoring can provide advanced warning of undesirable ecological change and thus permit managers to adopt an adaptive management approach to conserving biological diversity. Given the complexity of tropical forest ecosystems, following an adaptive management approach is essential. Secondly, ecological monitoring is a necessity in order to objectively evaluate whether project or protected area objectives of conserving biological diversity are being achieved. One of the major short-comings of most of the early integrated conservation and development projects has been the absence of a comprehensive ecological monitoring program (Kremen *et al.*, 1994). Thirdly, ecological monitoring is a necessity in order to evaluate the long-term impacts of human activities and disturbance on biological diversity. This is particularly true because there is often a lag between a disturbance event and a subsequent response. Fourthly, ecological monitoring can provide important insights into the functioning of complex ecosystems. Understanding the ecological dynamics of a forest is a perquisite to developing sustainable forest practices.

IMPORTANT CONSIDERATIONS IN DESIGNING AN ECOLOGICAL MONITORING PROGRAM

Prior to implementing any ecological monitoring program, there must be clear objectives and hypotheses. For the Eastern Arc forests, two obvious objectives of an ecological monitoring program are: (1) to enhance the understanding of the ecological dynamics of the forests; and (2) to evaluate the impact of human activities and disturbance on populations, species, communities, and landscapes. In relationship to the latter objective, a null hypothesis is that human activities do not adversely affect biological diversity while the alternative hypothesis is that human activities do adversely affect biological diversity.

ECOLOGICAL INDICATORS

Identifying what to monitor can be simplified if indicators of various functional and organizational levels can be identified (Noss 1990, Hellawell 1991). Identifying species and suites of species which are representative of various functional groups (primary producers, primary consumers, secondary consumers, tertiary consumers) is a strategy which has been frequently advocated (Kremen *et al.* 1993, 1994). In many cases, the suitability of species or suites of species as indicators of change may need to be pretested. In many tropical forests, epiphytes and orchids (Turner *et al.* 1994), butterflies (Hill *et al.* 1995), termites (Collins 1980), and dung beetles (Klein 1989), understory birds (Johns 1986, Newmark 1991, Thiollay 1992) and primates (Skorpua 1986, Weisenseel *et al.* 1993) have been found to be particularly sensitive to human disturbance and thus are useful indicators of ecological change.

CURRENT AND PROPOSED ECOLOGICAL MONITORING IN THE USAMBARAS

Since 1987, I have been monitoring annually understory bird populations on an archipelago of nine forest fragments and an adjacent control site in the East Usambaras. In 1989, I initiated a parallel study on a second archipelago of four forest fragments and an adjacent control site in the West Usambaras. The broad objectives this research are to evaluate the impact of forest fragmentation on understory bird communities, and to gain a greater understanding of the population dynamics of tropical forest birds. Specific objectives of this research are to examine (1) the metapopulation dynamics of understory bird communities on two archipelagoes of forest fragments whose total size are nearly identical but whose fragments differ in average size and distance from a control site; (2) variation in understory bird survivorship, natality, and movement within the two archipelagoes and across individual forest fragments; (3) how temperature, humidity, luminescence, and vegetation structure varies from forest edge to the interior and its relationship to the distance that understory birds species are encountered from the forest edge; and (4) the impact of past selective logging upon understory bird communities. (For more on this project see "Impact of Tropical Forest Fragmentation Upon Bird Populations in the Usambara Mountains, Tanzania, August 23 to Sepetember 7, 1999" on page 15 of this issue.)

Understory birds in the Usambara Mountains are quite sensitive to forest disturbance and thus appear to be good indicators of ecological change. However our understanding of the dynamics of forest ecosystems and the impact of human disturbance on biological diversity could be enhanced if additional suites of species which are representative of other functional groups are also simultaneously monitored. Efforts are currently under way through the support of the MacArthur Foundation

to develop a more comprehensive ecological monitoring program in the East Usambaras which will include additional functional groups and organizational scales.

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A NATIONAL BIODIVERSITY DATA BANK FOR UGANDA

Good quality data about living resources are essential for effective conservation planning, for example to mitigate the effects of industrial and agricultural development, and to rationalise the protection offered to endangered species by protected areas. Here we describe the National Biodiversity Data Bank (NBDB) in Makerere University, Kampala, which was set up to address the need for high-quality and accessible data on biodiversity. Although still in development, the data managed by the NBDB are already in use widely.

INTRODUCTION

Effective conservation planning depends on the existence of reliable data being available on the status and distribution of living resources. Such data enable rational systems of protected areas to be designed and for interventions to be planned cost-effectively in areas of high biodiversity or other conservation value. The two agencies in Uganda with primary responsibility for protecting living resources are both undergoing extensive reform and, in the process, a significant opportunity exists to employ biodiversity data in their strategic planning processes. These are the Uganda Wildlife Authority and the Uganda Forest Department.

Likewise, although not always sufficient, ecological audits and environmental assessments are now built in to many industrial and agricultural development projects from their outset, measuring potential impacts on vulnerable species or those with restricted range. Such assessments can lead to substantial changes in project design.

In data-rich countries, such as the United Kingdom, intensive and regular inventory work makes it possible to estimate the status and distribution of living resources to a very good accuracy. But in data-poor countries, like Uganda, less data have been collected, and what data exist, may vary in quality, method of collection and accessibility. Realistically, simple distribution data arising from *ad hoc* species observations and small scientific projects is the only near-term source.

Following the recommendation of a meeting of Uganda's conservationists in 1990 (Pomeroy, 1990), Makerere University Institute of Environment and Natural Resources (MUIENR) decided to document Uganda's living resources in a consistent way, with the intention of making this information available to all interested stakeholders. This paper describes the resulting facility—known as the National Biodiversity Data Bank (NBDB)—and gives examples of how it has been used for conservation planning.

THE NATIONAL BIODIVERSITY DATA BANK

Prior to the establishment of the NBDB there was no central facility in the country for storing and analysing data on Uganda's biodiversity. Work began humbly in 1990, using standard 'paper and file' methods, but two years later, the amount of data gathered was such that electronic data management was required. Thus, in 1993, an electronic database application was established which became known as the *Biodiversity Data Bank (BDB)*.

The application provided immediate impetus for the computerisation of key data, including lists of extant species in selected taxonomic groups (species names had previously been standardised in co-operation with MUIENR's partners across East Africa). Computerisation of tens of thousands of species distribution records—previously stored on paper sheets—soon followed, leading to the production of the NBDB's first output: a provisional national checklist of birds. Maps of Uganda's protected areas were computerised, together with further spatial data sets of administrative boundaries, human population, key climatic variables, vegetation, rivers, altitude and human infrastructure (roads, railways and towns etc.).

During the first quarter of 1994, the *BDB* application was upgraded from DOS to the Windows operating system which provided integration with further analytical tools and the ability to exchange data between database and mapping applications. A simple desktop mapping package was used to prepare simple maps of species' distributions, and to filter database records according to geographic criteria. The improved BDB application is now used for entry, checking, storage, retrieval, analysis and presentation of much of MUIENR's biodiversity data.

At the time of writing, the core data sets computerised by the NBDB included:

- Standard taxonomic lists of Uganda's birds, mammals, reptiles, amphibians, groups of insects (dragonflies and butterflies) and flowering plants. Other groups can easily be incorporated as new data become available.
- Over 40,000 field observations of birds and mammals. There are plans for entering further paper-based data on the distribution of Uganda's plants, butterflies, reptiles and amphibians.
- Boundaries and descriptions of Uganda's protected areas (National Biomass Study, 1996); administrative boundaries down to parish level (Department of Population and Census); and a gazetteer database holding descriptions of the geography and habitat conditions of the sites where species have been recorded.
- Details of individuals and institutions working with biodiversity information in Uganda. MUIENR was designated as the biodiversity node of the environmental information network co-ordinated by the National Environment Management Authority (NEMA).
- Miscellaneous maps and databases covering the country's lakes and rivers network, White's bio-geographic zones (UNESCO, 1983), rainfall and altitude (Government of Uganda, 1967), vegetation (Langdale-Brown *et al*, 1964) and an ecofloristic zone classification developed by F. Blasco and P. Legris and digitised by FAO for the entire tropics in 1990 as part of its Forest Resource Assessment Project (Green *et al*, 1996). New layers are frequently added, and existing ones improved.

Experience gained in the NBDB is shared with other departments and units within Makerere University. For example, partnerships have been established to computerise biodiversity records in Makerere University Herbarium and Makerere University Zoology Museum.

DATA COLLECTION AND ENTRY

Data are collected by MUIENR's field teams and other co-operating researchers and naturalists within and outside Uganda. Field data are entered onto two standard forms—a *biological recording* form and a *site survey* form—which match the fields in the database. Field observations arriving at the NBDB in hard copy are checked for biological and geographical accuracy before computerisation. Verification is by local experts, with occasional recourse to others in the East African region, (e.g. unusual bird records are sent to the Nairobi-based Ornithological Sub-committee of the East Africa Natural History Society).

Typographic errors are minimised by automatic checks during data entry, which ensure that irrational data values are not accepted. Data storage is relatively efficient: a relational data model is employed such that core data (*e.g.* place names or species names) are only entered once, also reducing typographic errors. Samples

of data are manually cross-checked periodically.

The BDB application enables field observations to be analysed with respect to environmental themes, including topography, climate, hydrology, vegetation and land use. This allows the NBDB to model the habitat preferences of different species in terms of the environmental conditions in which they are observed. Thus, for example, based on a number of separate specimens or distribution records of a certain mammal, its habitat preferences could be determined as 'above altitude X, min rainfall Y1, max Y2 , in areas with human population density lower than Z'

This approach has been applied extensively to the prediction of bird species' distributions, leading to the imminent publication of a *Bird Atlas of Uganda* in 2000. Further studies have enabled biodiversity 'hotspots' to be located, and overall biodiversity 'values' to be assessed (Tushabe *et al*., in press).

APPLICATION DESIGN

It is well recognised that information for conservation planning and policy development must be clear, timely and brief (see WCMC 1998 for a full analysis). For this reason the BDB application was designed to enable data to be analysed rapidly and output in the form of standard information products. Factors which allow the application to respond quickly to information requests include:

- Manual and electronic error-checking procedures for quality assurance
- A well-structured electronic filing system, capable of handling large volumes of data
- Quick and easy searching methods based upon standard query language (SQL)
- Predesigned analytical capabilities, including area-based species' lists, diversity figures and predictions of species' distributions
- Integration with other computer applications, notably desktop mapping and geographic information systems (GIS)
- A dedicated database development team, supported by an expert array of biodiversity researchers and discipline specialists.

USES OF THE NBDB

Major uses to which the NBDB has been put include:

- Analysis of biodiversity data for the Sango Bay region (Fuller *et al*., 1995, Bakamwesiga *et al*., in press), to enable the production of an integrated conservation and development plan (this work was supported by the United Kingdom's Darwin Initiative).
- Analysis of biodiversity data for Karamoja (Pomeroy & Tushabe, 1996) to enable the Uganda Wildlife Authority to reassess its protected areas policy, including prioritisation of different areas in terms of their relative biodiversity values.
- A *Bird Atlas of Uganda* (to be published in 2000) containing species' descriptions and both actual and predicted distribution maps, supported by the British Ornithologists' Club (BOC).
- Continuous provision of data and information products to researchers and other groups working in conservation projects in Uganda.

CONCLUSION

The National Biodiversity Data Bank at Makerere University has established itself as a centre of excellence for the management of biodiversity data. The NBDB's aim is to achieve a higher uptake of such data (and derived information products) in conservation planning and policy development, whether in government, industry or civil society.

By exploiting the best available knowledge on the status and distribution of Uganda's living resources, conservation measures can be designed in a cost-effective and strategic manner, rather than the reactive or *ad hoc* approaches which have characterised some past endeavours.

At present the Uganda Wildlife Authority and the Uganda Forest Department are both subject to long-term reform. It is hoped that both organisations will decide to utilise the extensive resources developed by the NBDB to place Ugandan conservation onto a secure scientific basis.

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KAKAMEGA FOREST: AN INTEGRATED CONSERVATION PROJECT

Kakamega forest is a part of what is today known as the Guineo-Congolian rainforest, scattered across Uganda, Zaire and Kenya. It is the only surviving rain forest in Kenya (Kokwaro, 1988). As such, the forest harbours central African flora and is distinct from the other forests of Kenya (WCMC, 1988). For the people of Kenya, the Kakamega forest is a precious remnant of the once vast trans-African rainforest ecosystem. It has very important biodiversity value with a remarkable diversity of plants, birds and insects not found anywhere else in the country.

BACKGROUND

Kakamega forest has been gazetted a forest reserve since 1933. The total remaining area of this forest was 24,000 ha (Kokwaro, 1988), but reports today show only 15,480 ha of which 13,888 ha is under natural forest and 1,591 ha is occupied by plantation (Forest Department, unpublished data). Between 10-20% of the total number of the animal species in Kakamega are found nowhere else in Kenya. The forest is also invaluable for the people living around it who depend on it for food, herbal medicines, fuel, building materials and general income. A recent valuation of the off-take of these multiple products from the forest gave a conservative figure of US$ 1.7 million a year (KIFCON, 1994). The forest also serves as a very vital water catchment area for the rivers flowing into Lake Victoria. The conservation of the Kakamega forest and its biodiversity is therefore of great importance to the local community and the world.

As human population increases, parts of the forest are being cleared or burnt. As a result, biological diversity has been decreased, there has been increased "desertification" and increased hardship for the local inhabitants. The exploitation of resources has taken place in such a haphazard, excessive, wasteful and uncontrollable way that not only is the forest resource steadily diminishing, but its capacity to recover is also being destroyed. The disintegration of the forest has also resulted in the breakup of the main forest block into smaller separate islands. An indicator of how rapidly the forest is disintegrating is the outcome of a 1991 survey (KIFCON, 1992), which compared standing timber volumes then with those from similar surveys 26 years before. It showed that in the short period, the forest had lost 50% of its volume. The study further estimated that it would take about 60 years of complete protection and without any other interventions to restore it to its 1965 condition.

The forest is surrounded by a hungry and growing population. In a survey of 15,000 of these households around the forest, 84% were found to use the forest to provide at least one basic commodity and each household was found to earn 9,020 Kenya shillings (US$ 120) per annum from forest use (Emerton, 1994). The population per square kilometre in the area is 268 as compared to 11 in the coastal forests (Wass, 1994). The Kakamega area is not only the most densely populated but still maintains the highest population growth rates in Kenya. The pressure is therefore very high, not only for forest products, but for conversion of forest land to agriculture. Fuel wood harvesting is very high and has been estimated to be about 100,000 cubic meters a year (KIFCON, 1992), much of it going into charcoal production. Calculations have shown the maximum off-take of fuel wood that the forest can sustain is about 20% of that figure. The demands made on the forest are now more than it is able to supply. There is a real danger that Kakamega forest could disappear in the next decade unless new approaches to these problems are developed.

Because Kenya has unsound economic, environmental/natural resource policies, and ineffective environmental laws that govern resource use, over exploitation of forest resources has been the order of the day country-wide. The current forest management set-up at Kakamega forest is inadequate to properly manage these forest resources sustainably. Conservation of the forest by using forest guards to patrol the forest and imposing penalties to offenders has been successful in the section of the forest managed by the Kenya

Wildlife Service but not so successful in the section managed by Forestry Department. World-wide experience has indeed shown that policing the forest only offers short-term solutions. In the long run people become resentful at losing access to the forest and become defiant towards the forest authorities. Effective solutions need a comprehensive management strategy involving local communities, scientists, health professionals, conservationists, educators, economists, policy makers and others.

Five factors have been identified as contributing to the rapid loss of Kakamega forest:

1. Inadequate, or lack of, knowledge and understanding among stakeholders about the importance of the forest and the need to conserve it.
2. Over-reliance on wood and fodder from the forest by the local community for cooking, building, furniture and cattle grazing.
3. Over-reliance on forest products by the local communities around the forest for income and traditional medicines.
4. Insufficient management and protection of the forest.
5. Rapid human population increase around the forest.

The International Centre of Insect Physiology and Ecology (ICIPE), concerned about the rapid loss of the forest, has been fundraising to address these factors responsible for the forest degradation. Funds have now been secured from the MacArthur and Packard Foundations and the Global Environmental Facility/ small grants programme to:

1. Promote community-driven environmental education to the local community living in the immediate catchment area of Kakamega forest in partnership with a local environmental group—the Kakamega Environmental Education Programme (KEEP).
2. Promote alternatives to forest-derived fuel wood and fodder, and fuelwood energy saving technologies, in partnership with the Intermediate Technology Development Group (ITDG).
3. Promote income-generating activities for the local community in partnership with Kenya Rural Enterprise Programme (K-REP).
4. Improve on existing resource management of the forest in partnership with several research institutions, Kenya Wildlife Service and the Forestry Department.
5. Reduce human population pressure on forest resources by improving family planning activities among forest adjacent communities. This is being implemented in collaboration with the Kisumu Medical and Education Trust and the Kenya Medical Association.

The need for environmental education

Many of the threats that are facing Kakamega forest are due to lack of or inadequate knowledge among stakeholders about the importance of the forest. Educating the stakeholders about the value of Kakamega forest is therefore a critical factor in its future survival. Environmental education to the local community will enhance acceptance of the forest conservation activities that will be promoted by the project. The immediate socio-economic catchment area of Kakamega Forest, estimated to comprise 57 villages with approximately 150,000 households forms a large potential audience for an environmental education program. A local environmental group initiated a program known as the Kakamega Environmental Education Program (KEEP) with the aim of teaching school children about the natural history of the forest, its usefulness and how it can be conserved. By educating the adult local community, ICIPE will complement the KEEP activities.

The need for alternatives to forest-derived fuel wood and fodder, and energy saving technologies.

There is a very high demand for indigenous tree species from Kakamega forest for timber, firewood, carving wood, charcoal production and for poles and sometimes for direct cash sales. The production of charcoal is a very profitable activity and is a common way of generating cash income to meet household needs. To convince the community to stop charcoal production and to reduce reliance on firewood from the forest, they need to be provided with an alternative source of income and energy. To bring exploitation levels down to sustainable levels nationally, it would mean a total annual income loss of about Kenya shillings 11 million for Kenya's forest adjacent dwellers. In a recent survey, 92% of households expressed the opinion that there is less wood fuel available than there had been in the past. There is, therefore, a perceived wood fuel shortage and interventions aimed at wood fuel conservation is expected to be welcomed by the community.

The need for alternative income generating activities for the local community

Conservation programs that are initiated in economically impoverished but biodiversity rich areas should be designed to provide economic incentives that benefit local stakeholders. This allows them to be partners in conservation activities (Western and Wright, 1994). The economic incentives should provide immediate benefits to the local people and ensure sustainability and should be related to conservation activities. This project will promote income generating strategies ideal for attaining both economic and ecological success. These strategies will include; apiculture (bee keeping) and sericulture (silkworm

rearing), cultivation of traditional medicinal plants and low impact dairy cattle keeping popularly known as "Zero-grazing".

Apiculture and Sericulture

Apiculture and sericulture have enormous potential in providing alternative income activities for the local communities in Africa such as those living in the immediate catchment area of Kakamega forest. In the past 5 years, ICIPE has undertaken extensive research, development and capacity building in these activities in East Africa. It conducts on-farm trials and testing of apiculture and sericulture technologies in four East African countries, including honey bee keeping, wild silk moth conservation and utilization, and domesticated silkworm rearing for fiber and food production. Over 5,000 farmers, NGOs and government extension personnel from the 4 East African countries have been trained at ICIPE in the two areas. ICIPE also acts as an intermediary between the farmers and traders to assist in the marketing of the resulting commercial products to the extent that the income of the participating farmers has increased by 40-60 percent. These technologies will be promoted among the local communities around Kakamega forest.

Community-based cultivation of medicinal plants

One of the causes of destruction of Kakamega forest is the collection of large quantities of plant material, particularly roots, bark and whole shrubs, by the local community, traditional medicinal herbalists and herbal medicine vendors for sale and use in traditional medicine. The collections are often uncontrolled leading to the destruction of many plants in the forest. The demand for medicinal plants is steadily increasing not only in developing countries but also in the industrialized nations. In both Europe and North America, the demand is fueled by an outburst of consumer interest in products that are "all natural" as well as by aggressive marketing of herbal remedies (Lewington, 1993). In Kenya a tremendous part of the population still relies on traditional medicine for its primary health care. Traditional medicine practitioners are known to serve 80-90% of the population (Chapya, 1996). Local community farmers around Kakamega forest will be encouraged to cultivate selected medicinal plants for their use and for sale of resulting products. The activity could serve a dual purpose of helping to ease pressure off the forest for herbal medicinal products while providing income to the community.

Credit Provision

Credit provision will be an important intervention required to raise both on-farm and off-farm opportunities to raise income for the forest surrounding households. This project will introduce credit facilities into the project area in collaboration with the Kenya Rural Enterprise program (K-REP). K-REP has in the past had marked success in providing loans, training, identifying and testing innovative methods for promoting micro and small scale enterprises to many rural communities in Kenya. Some of K-REP's most successful programs operate on the Grameen Bank model, requiring loanees to form small groups of co-guarantors. Promotion and delivery is managed by Area Credit Officers who lead and support a small number of credit officers, each maintaining a portfolio of borrowers. K-REP's repayments through this model run to an average of 98.6 percent.

The need for improvement of existing resource management of Kakamega Forest

The conservation of the indigenous forest resource, its biological diversity, ecological services and productivity should be supported by scientific research including inventorying and monitoring, training of parataxonomists to assist with the inventorying and monitoring, and categorization of land use types so as to understand the dynamics of the resource base and how it can be conserved efficiently. Management activities should support indigenous tree plantation development for the restoration of degraded forest habitats and to support local community wood requirements. In addition physical protection of the forest resource is mandatory to ensure forest preservation.

Inventory and monitoring

Kakamega forest is renowned for its flora and fauna, with many endemic and rare species. The main aim of inventorying and monitoring will be to provide baseline data on the diversity and distribution of key groups of potential indicator organisms, rare and threatened species. The inventorying will be a short-term survey of broad taxonomic groups for multiple purposes, including facilitating choice of narrow groups for monitoring, and training parataxomists in handling diverse taxa. Monitoring will be an on-going activity (in annual cycles) aimed at characterising forest health and measuring changes over time. The information from inventorying and monitoring will be used to guide immediate and long-term management, policy and decision making at the forest. It may also help identify additional non-timber products in the forest. The information will also assist in defining the impact of human activities on biodiversity and provide the essential biological information required for planning, management and evaluation for this project.

Training of Parataxonomists

Studies in many countries have shown that villagers who rely mostly on forest resources often possess exceptionally detailed knowledge of forest animals and plants, only a portion of which has been recorded in writing. This traditional knowledge can be developed into crucial skills for biological research. Given adequate training, local villagers can become parataxonomists and qualify for a variety of tasks related to biological research, monitoring, and education by performing preliminary sorting to species, as well as

at performing simple field and laboratory experiments and observations, becoming qualified field assistants in biodiversity surveys. Their work would result in quality material and data that can be deposited in national collections and available for taxonomic studies, as well as in new, valuable ecological data on the specimens. Further, they will learn how to record the field collected information to computer databases and document plant and animal specimens by taking both conventional and digital pictures. The niche for parataxonomists is a distinct one, as opposed to the passive role of a local informant or "field assistant". The parataxonomists truly stand "at the side" of biologists, as also implied by the name. Involvement of local communities in ecological research helps demonstrate the value of the forests, both in theoretical and in economic terms, by providing employment. There is no substitute for the conservation value of local people taking pride in their resources and in teaching others about them. While university students or graduates who might be brought in as research assistants tend to tire of remote locations and move back to the city, many local people are delighted to have good jobs that they can do without leaving their homes.

Land use and Land cover Patterns at Kakamega forest

Efficient allocation of resources in Kakamega District is only possible if current data on land use and land cover is available. Decision makers need data on parameters that influence land use to be able to plan for the people of the District. Changes in land use should be monitored so that development plans can be adjusted to changing needs. The land use/land cover data will also be used to guide the activities of this project, in addition to providing base maps to support environmental education programs on how the forest has changed in area and intensity of use over time. This information will be developed by the department of Resource Surveys and Remote Sensing.

Restoration ecology

Restoration ecology can be used to reverse the trend of degraded land in Kakamega forest and restore it to a functional ecosystem while providing new habitats for biodiversity. Restoration ecology has become a standard part of conservation activities as it is able to speed the recovery of degraded lands before substantial losses of biodiversity has occurred and provides an important means of allowing a significant number of species to recover. Options for restoration activities in this project will be combined with economic incentives by planting harvestable commodities.

Forest Protection

The active protection of the remaining indigenous forest will be enforced to prevent further fragmentation and degradation of the forest. Kakamega forest was gazetted in 1933 and has national Forest Reserve status. However, it has continued to be degraded. This project must therefore address the problem by ensuring effective policing by the government organizations involved by strengthening their capability.

The need to reduce population pressure on forest resources.

Kakamega forest area is not only the most densely populated but still maintains the highest population growth rates in Kenya. The interface between rapid population growth and environmental degradation is clear. According to Murai (1995), uncontrolled population increase is the biggest crime of humanity, because it induces both environmental and ecological destruction through excessive deforestation, urbanization, agricultural development, overgrazing, etc. It is generally believed today that reducing the population is one of the possible solutions to deforestation (Sayer, 1992). Sustainable development espoused at the Earth Summit held in Rio de Janeiro in 1992 cannot be achieved without establishing critical synergy between population growth and environmental preservation. It is unfortunate that to date population and environmental scientists continue to work in isolation, taking little heed of the commonality in their mission. To help to reduce population growth rates around the forest, ICIPE has entered into partnership with the Kisumu Medical and Education Trust and the Kenya Medical Association to strengthen the existing management of population growth rate in the area by Government and Non-Governmental agencies. This involves introducing effective family planning methods in addition to education for eventual reduction of the population growth rate at the Kakamega forest area.

ICIPE's core interests relate to insects, management of pests, conservation of ecosystem services, and promotion of new non-timber forest products. We have recognized Kakamega as an excellent model system in which to pursue research and applications in these areas mentioned above. But we have also realized that conservation of beneficial insects, their ecosystem services (e.g. pollination) and their habitats, requires integrated solutions to many problems. We have also been asked for assistance in these issues by local groups such as the Kakamega village conservation committee and Kakamega Biodiversity Conservation Tour Operators Association. We seek primarily to catalyze action while opportunities still exist. We endeavor to involve appropriate partners in all aspects of the work.

The proposed project will build on previous research undertaken by the Kenya Indigenous Conservation Programme (KIFCON), at Kakamega. They undertook surveys on the status and patterns of change, and on initial piloting of new approaches to management which incorporated community participation and support. They also undertook to strengthen institutions that had been involved in the conservation of Kakamega forest and supported development for forest conservation and management.

POTENTIAL IMPACT AND BENEFITS OF THE PROJECT

Expected benefits from environmental education will include greater awareness of the importance and urgent need for the conservation of Kakamega forest. This is expected to result in change of people's day-to-day behaviour. This will assist directly or indirectly with forest conservation, their dependence on forest resources will be reduced and therefore, less pressure will be exerted on the forest resources. The local community will be aware of the disadvantages of grazing within the forest. Responsible and controlled grazing will enable growth of saplings and eventual reforestation of degraded areas. With adoption of energy saving technologies and on farm forestry, the demand on the forest wood resources is expected to reduce. Production and marketing of energy saving technologies will result in increased income and heightened awareness on the existence of improved energy saving technologies. Income generating activities will provide economic impact to impoverished villagers. Employment potential and opportunities will be increased by all the income generating activities. Direct revenue channelled to local community development will raise the standard of living of the local community around Kakamega forest and the dependency on forest resources for cash income will be reduced. Involvement of village communities in ecological research will help demonstrate the value of the forests, both in theoretical and economic terms. There is no substitute for the conservation value of local people taking pride in their resources. Inventorying, monitoring and land use data will provide inputs for improved decision-making and optimal planning for land resources at the Kakamega forest. With strengthened family planning activities, there will be human population reduction and subsequent reduction of population pressure on forest resources.

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MARSABIT FOREST: A KEY RESOURCE IN NEED OF PROTECTION BY ALL STAKEHOLDERS

The semi-arid and arid rangelands of Northern Kenya generally characterised by harsh ecological conditions are fragile and prone to natural resources degradation. They are traditionally utilised for extensive pastoral livestock production (Schwartz and Schulta, 1995). However, there are pockets in some mountain regions with conditions favourable to rainfall agriculture and other land use practices. Natural conditions in Marsabit District differ widely (Schwartz, *et al.* 1991). There are vast lowlands ranging from 400–700 m a.s.l. which are interspersed with several mountain ranges reaching altitudes of more than 2,700 m a.s.l. The mountains are characterised by an evergreen tropical mountain forest vegetation type.

Forests of Kenya can be summarised into six blocks (Anon, 1992). Among these blocks are the northern mountains which compose Marsabit, Ndotos, Mathews, Leroghi and Kulal. Marsabit forest is distinct in that it

is widely separated from the others and differs in both structure and composition. They all, however, have similar dry forest dominated by *Podocarpus* and *Juniperus* (Lusigi, 1984 and Wass, 1995). Marsabit forest is partially semi-deciduous, the main vegetation being trees, forming dense stands over large areas of approximately 3,000 hectares, with their own bioclimates (MALDM, 1995 and Schwartz *et al.*, 1991).

The forest is rich in biodiversity, habitats and complex ecosystems that are crucial not only to the local community, but also rest of the world (Kirubi, 1998). The commonest large trees are *Casaeria, Croton megalocarpus, Strombosia, Diospyros abyssinica, Olea africana, Olea capensis, Cassipourea* and *Apodytes*. Among the commoner shrubs and smaller understory trees are the *Canthium* spp., *Ochna* spp., *Teclea nobilis, Ritchiea* and *Rinorea* (Lusigi, 1984). Important animals in the forest include elephants, buffaloes, baboons and antelopes (MPND, 1994). Moreover, it is estimated that 350 bird species are found within the forest (IUCN/UNEP, 1987). Nature reserves are key areas for protecting forest diversity (Anon., 1992). Marsabit forest is situated as an isolated forested mountain within the Marsabit National Reserve of 113,200 ha (IUCN/UNEP, 1987).

As a result of increased settlements and human population in the resent years within the semi-humid zone and on the semi-arid slopes of Marsabit Mountain, there is increased demand for the woody resources from the forest. It is extensively used for collecting firewood and building material (IPAL, 1983). As no felling of large trees is allowed in the forest and poles required for building must be thin (5-30 cm) people cut young trees with no replacement (Lusigi, 1984). Deforestation and the attendant loss of the indigenous biodiversity are the key ecological impacts observed by Kirubi (1998) and are attributable directly to the demand of 5600 tonnes of fuelwood per year. These effects are compounded further by the pressure from farming land which now forms part of the major land use on Marsabit Mountain.

For the purpose of attaining the goal of protecting this key resource, there is a need for all the stakeholders to appreciate both the productive and protective roles it plays.

Kenya Agricultural Research Institute (KARI)-Marsabit with financial support from the EU-KARI Agricultural Research Support Programme (ARSPII) is currently undertaking a project that is examining the socio-economics and environmental impact of the changing land use practices on Marsabit Mountain. This is with a focus on the woody resources, especially around the settlement/forest interface. The ultimate output will be a contribution to developing appropriate and sustainable utilisation of the woody vegetation in the vicinity of Marsabit forest.

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Table 1. The more visible stakeholders of the Marsabit forest as observed by Klinken and Mutharia (1998).

Stakeholders	Basis
Kenya Wildlife Service (KWS)	Wildlife present in the forest.
Forest Department	Income from utilisation of forest resources.
County Council	Jurisdiction over reserve, need for land for expansion.
income from utilisation	
GTZ	Forest resource utilisation concern, integrated
development project	
Local Community	Access to resources for subsistence.
Government Departments	Resource management mandate development needs.

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EARTHWATCH

IMPACT OF TROPICAL FOREST FRAGMENTATION UPON BIRD POPULATIONS IN THE USAMBARA MOUNTAINS, TANZANIA AUGUST 23 TO SEPTEMBER 7 1999

Tropical forest fragmentation and destruction is an issue of global concern. While there is considerable concern about the loss of tropical forest, there are very few long-term studies examining the impact of tropical forest fragmentation upon vertebrate communities. In his study, Dr. William Newmark has been monitoring the impact of forest fragmentation upon understory bird populations in the East and West Usambara Mountains of Tanzania for twelve consecutive years. The Earthwatch fellowships have allowed several Kenyan researchers to take part in this project.

THE STUDY

The Study Area

The Usambara Mountains contain the highest known diversity and endemism of plant and animal species in East Africa. They are part of a larger range of mountains in eastern Kenya and Tanzania termed the Eastern Arc Mountains, which have been recently declared one of the fourteen most endangered tropical forest ecosystems or hotspots world-wide.

Located in North-eastern Tanzania about 50 km from the coast, the East Usambaras are made up of intermediate forest fragments scattered in the vicinity of Amani. These fragments range in altitude from 300-1500 m. As a result of their physical proximity to the Indian Ocean and their elevation, these forests are very effective in capturing precipitation and receive fairly high rainfall all year round. The study site at East Usambara was located at an altitude of about 900 m. Nine forest fragments have been selected for this study. Three of these are "mainland" or control sites with fairly undisturbed intact forest, and the other six are smaller fragments at different levels of disturbance.

Objectives and Methods

The main objective of the study was to investigate the effects of forest fragmentation and disturbance on understory birds at nine selected sites in East Usambara. We did this by:

- Sampling understory bird species using mist nets at three control sites and six fragments differing in disturbance
- Documenting population variability of understory bird species between and within the sites
- Measuring vegetation structure at randomly selected points in the nine study sites by estimating percentage herbaceous ground cover, density of trees greater than 30 cm in girth, density of woody vegetation less than 30 cm in circumference, understory vegetation vertical cover less than 2.5 cm in height and measuring *Maesopsis* (a colonising tree species) less than 10 cm and greater than 10 cm in girth
- Estimating food availability by collecting and sorting leaf-litter invertebrates
- Scaling the effect of fragmentation on microclimate by taking simultaneous measurements of temperature, relative humidity and luminescence at three sites differing in terms of forest disturbance.

Understory Bird Sampling

Understory birds were sampled using mist nets. The nets were deployed from dawn to dusk in a linear fashion through the forest so as to completely bisect the forest fragments. This made it possible to show bird distribution and composition from the forest edge to the interior.

At each study site, nets were put up for an average of three days each. During our stay, we mist netted at the three control sites and in two slightly disturbed fragments. The remaining four sites were to be sampled after we departed. All the nine forest fragments being studied are located on tea estates created between 60-100 years ago when the native forest was felled.

Each net is 13 m in length and is suspended between two numbered poles. When a bird was trapped in the nets, the pole numbers were noted. This helped to estimate at what distance from the forest edge the bird was caught. Fellows assisted in setting up the nets on arrival, and helped carry the birds to and from the study sites for processing. The Principal Investigator allowed a few fellows to handle the birds, but carried out all the biometric measurements himself. He explained about the different types of rings used, and other ringing equipment.

Newly captured birds were ringed, and weight, tail and bill measurements taken. Recaptures had the ring number recorded and were weighed. Where possible, age and sex were noted.

Preliminary results showed there was a decline in the number of Thrushes ringed at the control sites.

Vegetation Structure

There have been suggestions that forest interior species are adversely affected by changes in the structure of understory vegetation. We sampled vegetation structure

in all nine sites. In the six fragments differing in disturbance we measured understory vegetation structure as well as vertical vegetation density. At the three control sites, we estimated tree density and disturbance.

Vegetation sampling was done by first selecting random points using a random numbers table. These points were then plotted on a grid map of the site. Fellows were divided into three teams of three people, and a fourth team of four people, including some local field assistants. Each team then selected a pacer, recorder and measurer. The latter was also responsible for most of the equipment. Each pacer from each team then calculated the length of their pace. Measurements to get to each random point were then converted to number of paces. For the first three teams, equipment included a compass to accurately reach the random point, four long, tagged poles and 3 m rope to measure out 3x3 m plots. Each team also carried 3 short, tagged poles and 1 m rope to mark off 1x1 m plots, as well as a tape measure to measure the diameter of trees and *Maesopsis* at chest height. A tagged stake was also carried to mark the point at which the pacer veered from the forest path to get to a random point.

At each point, we marked off a 1x1 m plot and a larger 3x3 m plot. Percentage ground vegetation cover was then estimated at the smaller quadrant. In the larger 3x3 m plots, the number of stems less than 30 cm in girth, as well stems greater than 30 cm in girth were counted. To get an indication of disturbance, all *Maesopsis* less than 10 cm in girth were counted and diameter at chest height measured for those greater than 10 cm in girth in the larger quadrants.

The fourth team sampled vertical height density in all the study sites. They measured the understory vegetation vertical cover less than 2.5 m in height at each site at random points and from a random angle using a vegetation profile board delineated in 5 m sections.

Food Availability

Forest interior species are thought to be particularly affected by forest fragmentation and disturbance. One possible explanation for this is that forest disturbance affects food availability. We sampled leaf-litter invertebrate biomass from all nine forest fragments.

One fellow was assigned the task of collecting leaf-litter samples at thirty random points from each study site. These samples were then placed in Berlíz funnels and then exposed to the sun. This helped separate the invertebrates from the leaf litter. Fellows then took turns in removing invertebrates specimens from the funnels' collecting cup and sorting through the dried leaf litter for specimens that had not fallen into the collecting cups. The specimens were then put in labelled plastic vials, with some preservative alcohol. These were to be oven-dried and weighed later, to estimate food availability.

Microclimate

A secondary effect of tropical forest fragmentation is that the microclimate and physical environment of the forest is altered. It has been hypothesised that many understory birds are adversely affected by forest fragmentation and disturbance because of changes in the forest microclimate. Understory birds vary greatly in the distance that they are encountered from the forest edge. By monitoring temperature, relative humidity, light intensity and understory vegetation structure within the control sites and relating the distance with which a species is captured on average from the forest edge, it should be possible to correlate these parameters with understory bird distribution.

At three sites that differed in terms of forest disturbance, fellows made five different simultaneous recordings of temperature, relative humidity and luminescence. Temperature and humidity were measured using a thermohygrometer and luminescence was measured using a lux meter. These measurements were taken along four transects 15 m apart at 0 m, 20 m, 40 m, 100 m and 200 m from the forest edge at each site. At each point along the transect, four measurements of each microclimatic parameter were recorded at chest height approximately 1m apart in the four cardinal directions.

KNOWLEDGE GAINED

As a database co-ordinator and records officer, my work has been largely restricted to the office. As a result my field experience was very limited. Earthwatch provided a perfect opportunity for me to participate in a field study, where I was able to learn many new field techniques. The project also afforded me a unique opportunity to interact with fellow African professionals with a shared common interest in birds. Though I had some prior bird ringing experience, it was mostly as a scribe. At the Usambara bird project, I learnt how to erect and put down mist nets, and observed how to remove birds from nets properly. I also learnt the use of sequentially numbered poles, and uniform sized nets.

Vegetation sampling, leaf-litter invertebrate sorting and monitoring microclimate were all new experiences. The use of a random numbers table in the selection of random points for a study site was also a first. I also learnt, sometimes painfully, how to reach a seemingly inaccessible random point! The project was an invaluable learning experience on bird monitoring field techniques. I hope to put these techniques to good use when I attend a similar study as part of a colleague's Ph.D. research on the globally threatened Taita Thrush *Turdus (olivaceus) helleri*. This study is being conducted at a patchwork of forest fragments that make up the Taita Hills Forest. Like the Usambaras, the Taita Hills are part of the larger range of Eastern Arc Mountains. It is an Important Bird Area (IBA) and one of Kenya's endangered tropical forest ecosystems.

I took photographs of some birds in the hand, which will be added to the departmental collection of bird photos. Some of these birds were lifers, which have boosted my stagnating life list. As I will encounter similar birds at Taita Hills, it is useful to have had

some prior experience with these species at Usambara. Furthermore, as I explained during my presentation at Usambara, I hope to use some of the skills acquired to initiate a study on the threatened Abbott's Starling *Cinyricinclus femoralis* as part of a Masters Program.

Lastly, it was refreshing to actually see, hear and handle live birds in their natural habitat, instead of staring at pictures in bird guide books—an integral part of my work!

OTHER EXPERIENCES

At the end of our two-week stay at East Usambara, Dr Newmark commented on how well fellows in our group interacted with each other. This was absolutely true! All fellows got along remarkably well which added to the general morale of the team. Humorous exchanges in adverse conditions were frequent which made the whole experience quite memorable.

The majority of the fellows are professionals working as persons in charge of important bird conservation programs in their countries. Many, like myself, were not accustomed to gruelling fieldwork but everyone took to their tasks with enthusiasm and determination. Presentations in the evenings were interesting and informative, a fact easily evidenced by the numerous insightful questions that followed each session.

Dr Newmark gave clear outlines of each day's activities the night before, making sure we understood our tasks. He was happy to answer all questions at length on his study. He also talked about other parallel monitoring studies on epiphytes, dung beetles, frogs and hornbills.

Fellows' Presentations and Interaction

The two gentlemen from Cameroon gave an interesting account of their work in the Kilum-Ijim long-term monitoring Forest Project at the Bamenda Highlands, a BirdLife initiative. Some of the large scale monitoring techniques employed in their project would be very appropriate if adopted in some similar studies in Kenya. Two Masters students from Madagascar talked about their research work on threatened Malaysian bird species, with detailed accounts on their fieldwork. Another student from Ethiopia talked about his postgraduate study at the University of Norway. He also gave an account of his previous job, which was on the IBA's (Important Bird Areas) of Ethiopia, another BirdLife project. A fellow from Côte d'Ivoire, but working in Senegal, and a colleague from Madagascar talked about their work on wetland birds. They were both scheduled to attend an International Wetland Workshop in Madagascar, a week after the Earthwatch project. The gentleman from Madagascar was co-ordinating the workshop. Another fellow talked about her teaching work at the Islamic University in Mbale, Uganda, and discussed the results of her recently concluded Masters program. A fellow from Congo talked about his postgraduate studies at Makerere University, Uganda. He also talked about two conservation societies—Nature Uganda (Uganda branch of the East African Natural History Society) and ARCOS (the Albertine Rift Conservation Society). The Science Officer from Earthwatch talked about the lengthy process of selecting proposals as potential Earthwatch projects. She also answered questions about the functions and operations of Earthwatch. The Kenyans, who were the last to give their presentations, talked about their work on birds, databases, IBA's, and forest conservation. Contacts were exchanged, e-mail addresses up-dated and promises made to keep in touch after the project.

The three fellows from Madagascar and a fourth from Senegal had a three-day stopover in Kenya. They had an opportunity to visit the National Museums of Kenya, talk with researchers at the Department of Ornithology, catch up with old friends as well go shopping! Unfortunately for the two fellows from Cameroon, they were denied a similar opportunity by visa complications which saw them spend a cold night at the airport in Nairobi—a very distressing incident.

The Local People and Facilities

Due to our intense and tight work schedule, we had very little free time. We were therefore not able to interact with many of the local peoples. However, the few we met were fairly friendly and hospitable. The local field assistants were amicable and quick to assist when required. They were also eager to teach any willing fellow the Kiswahili language, which is spoken throughout Tanzania. It was a pleasant surprise to note that fellows from Uganda and Congo also spoke the language well. The local cook tried to make good of the limited variety of food available, and always had a thermos full of hot water for a quick warm-up drink. Our accommodation was adequate, especially for the ladies. But I am afraid our male counterparts (all nine of them) were provided only one tent! Fortunately, two extra tents from members accommodated four gentlemen and helped ease congestion. Large tarpaulins were erected over most of the camp and all managed to keep dry when it rained. The outdoor toilet and bathroom facilities were basic but well improvised and well maintained.

The food was sufficient and started out with some variety. However, this rapidly deteriorated to bland, repetitive rice and beans. Even after a hard day's work, one did not look forward to any of the meals. Towards the end of our stay, a chance encounter with the TBA (Tropical Biology Association) team while in the field was a godsend. The sympathetic and generous director of TBA invited all to dinner and dancing at their Amani camp on the last night of our stay. Though we had one free day at Amani, the dinner-dance with the TBA group was definitely the highlight of our social life at Usambara!

IMPROVEMENTS TO THE PROGRAMME

The information packs on the project, logistics of getting

to the rendezvous point, planned worked schedule, etc. were all very useful. Fellows, however, should fly to Dar es Salaam rather than via Mombasa to minimise immigration problems, as we spent quite a bit of time at the Kenyan and Tanzania borders. The travel arrangements for fellows who used the Mombasa-Tanga route were well co-ordinated and the driver/guide quite familiar and helpful with the border procedures. Unfortunately, he gave us a hair-raising ride to Tanga, a distance he covered in the record time of five hours—this was inclusive of the half an hour ferry crossing and two hour border stops. It took the fellows from Madagascar twelve hours to cover the same distance using the local bus service. They thought it went too fast. Promises that the guide would be more careful on the return trip proved fruitless. He did reduced his speed slightly, but only because he was dozing at the wheel!

The tents provided were in fairly good shape, but perhaps one more should be added to ease congestion.

The food though adequate, was quite bland and repetitive towards the end. However, the sumptuous food served at the Panori Hotel in Tanga more than made up for this! It was an excellent choice of lodgings for our interim stay before and after the gruelling fieldwork. It was good that fellows had been warned that they should be in good physical shape as the work schedule was very intense and demanding.

The selection of fellows with a keen interest in birds made the team composition very well suited for the project. The fact that we were largely all from Africa did not hinder information flow and new ideas were exchanged and debated at length. Useful contacts were made and firm friendships forged.

All in all, it was a most enlightening and memorable experience!

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SHORT COMMUNICATIONS

THE TAXONOMIC TANGLE OF A KENYAN *SANSEVIERIA*

For some years I have been puzzled by a *Sansevieria* plant that is quite widespread in Kenya. Localities where I have collected this species range from Marich Pass in the north to Wanta Hill in the south, in the Rift Valley and along the eastern side of it. The plant consists of an acaulescent rosette of about six large leaves up to 50 cm or more long × 8.5 cm wide, spreading by means of a thick underground rhizome, about 5 cm in diameter, and bearing a dense unbranched inflorescence. The plant is illustrated by Schulz & Powys (1998: page 73), and following Teketay (see below) I had suggested the name *S. forskaoliana* for this picture in the book's proof stage, though this was (perhaps rightly) queried later by Juan Chahinian (pers. comm.).

Very few species have been described in Kenya since the monograph of N.E. Brown (1915), and this plant is clearly not one of the novelties (Newton, 1996). Therefore, I started by trying to identify it in Brown's account. Brown did a remarkable job in pulling together everything that was known about the taxonomy of the genus at the time, but anyone who has tried to identify a *Sansevieria* plant with his monograph will know the frustration that is induced by the exercise. Many of the species were described from cultivated plants at Kew, U.K., in some cases with no record of their origin (e.g. *S. patens*: "Tropical Africa. Origin unknown, but probably British East Africa" and *S. varians*: "Country unknown"). Also, some descriptions are incomplete. By following Brown's key I reached the name *S. chinensis* Gentil, a taxon described from a cultivated plant whose origin is completely unknown. Juan Chahinian, who knows more about sansevierias than I do, strongly believes that the plant is not *S. chinensis*.

The distribution range of my plant falls partly within the area of Agnew's flora of the Kenya highlands, for which a key to the genus *Sansevieria* was written by Mbugua (1994). Here my plant keys out to *S. conspicua* N. E. Brown, which I had thought was found only in the coastal region. Mbugua himself, when I showed him my plant, said unhesitatingly that it is *S. braunii* Engler & Krause, which is not included in his account in Agnew's book. Indeed, it appears to be the plant featured by him later as *S. braunii* (Mbugua, 1998), though the remarkably thick rhizome and rosulate leaf arrangement are not mentioned. *Sansevieria braunii* was originally described from material collected in Tanzania. According to Pfennig (1977) *S. braunii* has a capitate inflorescence. The type specimen of *S. braunii* is in the East Africa Herbarium (EA) in Nairobi (not BM as stated by Mbugua, 1994), and it has a distinctly cylindrical inflorescence. Furthermore, in the protologue of *S. braunii* (Engler & Krause, 1911) it is stated that the flowers are 10-11 cm long, as can also be seen on the type specimen, and that certainly does not apply to the plant discussed here. The type locality of *S. braunii* is in south-western Tanzania, and I have never seen the Kenyan plant anywhere in the intervening area in northern Tanzania. I have yet to look for the type locality and see what is growing there.

Yet another possible name for the plant came from recent accounts of Ethiopian species. Pictures of *S. forskaoliana* (Schultes fil.) Hepper & Wood in a paper by Teketay (1995) look remarkably like my plant, and the text does indicate that this species occurs in Kenya. However, the description in the same paper states that each shoot has only 1-2 leaves, which is inconsistent with the pictures. According to Friis (1995)

the original description of *S. forskaoliana* gave no details of leaves, and the type specimen does not include leaves. Presumably the "1-2 leaves" is taken from the description of *S. abyssinica* N. E. Brown, which has been reduced to synonymy under *S. forskaoliana* (Hepper & Friis, 1994). The account in the Ethiopian flora (Teketay, 1997) follows the same author's 1995 paper.

Confused? So am I. However, after I had been looking into this plant for some time, and was beginning to suspect that it might be an undescribed species, I heard that it is now to be described as a new species by someone else. Whilst waiting for the description to appear, I thought it worthwhile to present an account of the frustration I have had in trying to identify it, to demonstrate why it is not always easy to give a name for a plant.

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